Chapter 4: EtherChannel and HSRP

CCNA Routing and Switching

Scaling Networks

Chapter 4 - Sections & Objectives

- 4.1 Link Aggregation Concepts
  - Explain link aggregation operation in a switched LAN environment.
    - Describe link aggregation.
    - Describe EtherChannel technology.
- 4.2 Link Aggregation Configuration
  - Implement link aggregation to improve performance on high-traffic switch links.
    - Configure link aggregation.
    - Troubleshoot a link aggregation implementation.
- 4.3 First Hop Redundancy Protocols
  - Implement HSRP
    - Explain the purpose and operation of first hop redundancy protocols.
    - Explain how HSRP operates.
    - Configure HSRP using Cisco IOS commands.
    - Troubleshoot HSRP.

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4.1 Link Aggregation Concepts

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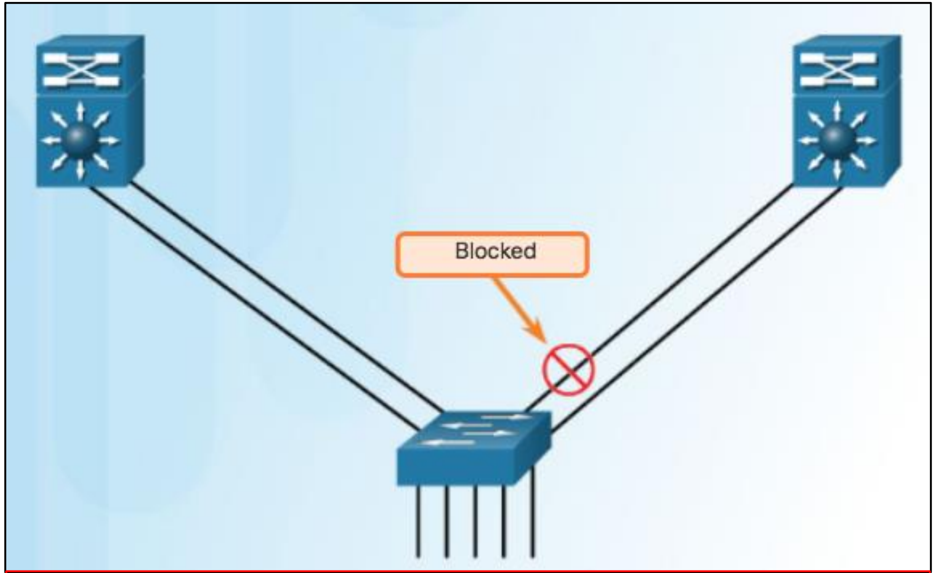
Introduction to Link Aggregation

- It is possible to combine the number of physical links between switches to increase the overall speed of switch-to-switch communication.
  - STP will block redundant links to prevent routing loops.



Redundant Links with STP (by default blocked)

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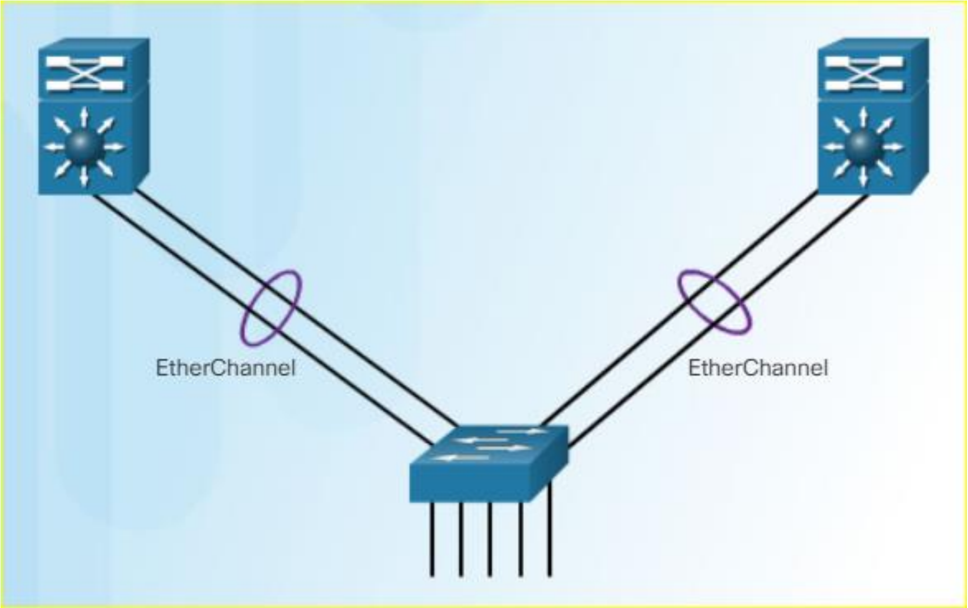
Advantages of EtherChannel

- Most configuration tasks can be done on the EtherChannel interface instead of on each individual port.
- EtherChannel relies on existing switch ports.
- Load balancing takes place between links that are part of the same EtherChannel.
- EtherChannel creates an aggregation that is seen as one logical link.
- EtherChannel provides redundancy because the overall link is seen as one logical connection.



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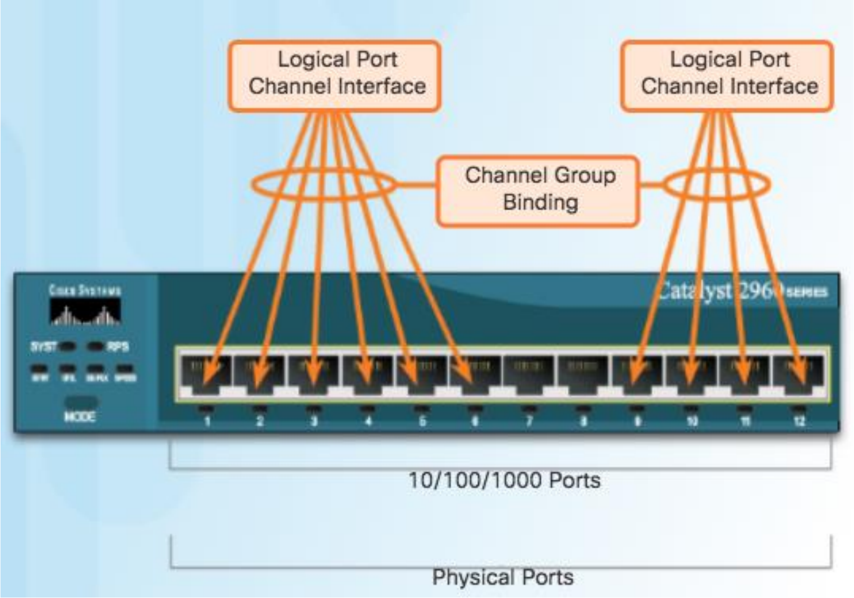
Implementation Restrictions

- EtherChannel groups multiple physical ports into one or more logical EtherChannel links.
- EtherChannel Restrictions
  - **Interface types cannot be mixed.** (Fast Ethernet + Gigabit Ethernet cannot be grouped.)
  - Provides full-duplex bandwidth up to 800 Mbps (Fast EtherChannel) or 8 Gbps (Gigabit EtherChannel)
  - Cisco IOS Switch can support 6 EtherChannels.
  - Created between two switches or a server and switch.
  - If one side is configured as trunk, the other side must be a trunk within same native VLAN.
  - Each EtherChannel has a logical port channel interface and changes to a channel affects its physical interfaces.



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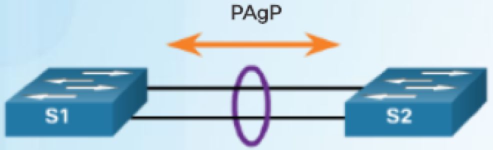
Port Aggregation Protocol

- EtherChannels can be formed by using PAgP or LACP protocol
- PAgP (“Pag-P”) Cisco-proprietary protocol

PAgP modes:

- On: Channel member without negotiation (no protocol).
- Desirable: Actively asking if the other side can or will participate.
- Auto: Passively waiting for the other side.



S1	S2	Channel Establishment
On	On	Yes
Auto/Desirable	Desirable	Yes
On/Auto/Desirable	Not Configured	No
On	Desirable	No
Auto/On	Auto	No

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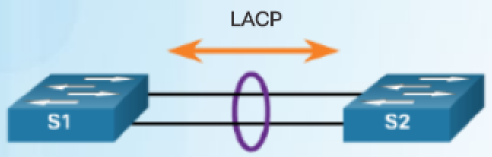
Link Aggregation Control Protocol

- LACP multivendor environment

LACP modes:

- On: Channel member without negotiation (no protocol).
- Active: Actively asking if the other side can or will participate.
- Passive: Passively waiting for the other side.



S1	S2	Channel Establishment
On	On	Yes
Active/Passive	Active	Yes
On/Active/Passive	Not Configured	No
On	Active	No
Passive/On	Passive	No

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4.2 Link Aggregation Configuration

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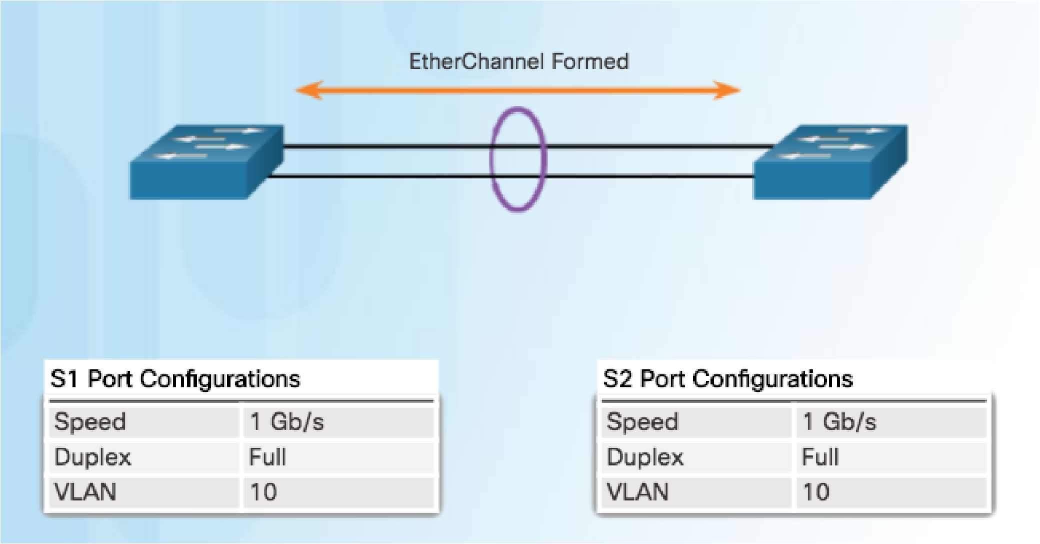
Configuration Guidelines

- Configuration Settings Match on Both Switches
  - Same speed and duplex mode.
  - All interfaces in a bundle must be assigned to the same VLAN, or configured as a trunk.
  - Trunk must support same range of VLANs.



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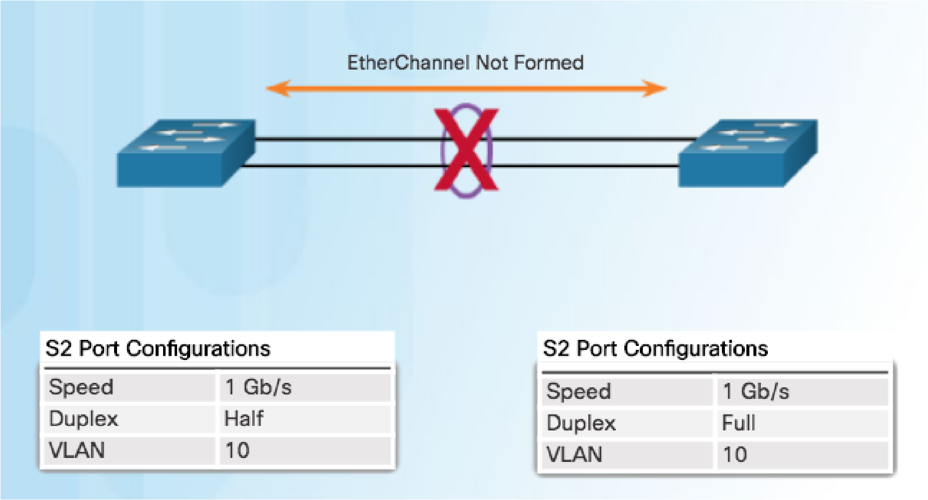
Configuration Guidelines (Cont.)

- If Configuration Settings Do Not Match
- EtherChannel not formed between S1 and S2



Note: When changing settings, configure them in port channel interface configuration mode. The configuration applied to the port channel interface also affects the individual interfaces.

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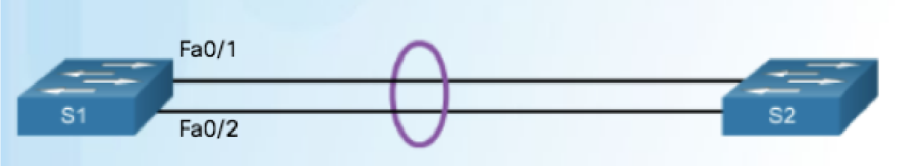
Configuring Interfaces

- This configuration creates EtherChannel with LACP and configures trunking.
  - Step 1: Specify the interfaces that compose the EtherChannel group.
  - Step 2: Create the port channel interface with the **channel-group** command in **active** mode. (Channel group number needs to be selected.)
  - Step 3: Change Layer 2 settings in port channel interface configuration mode.

```
S1(config)# interface range FastEthernet0/1 - 2
S1(config-if-range)# channel-group 1 mode active
Creating a port-channel interface Port-channel 1
S1(config-if-range)# interface port-channel 1
S1(config-if)# switchport mode trunk
S1(config-if)# switchport trunk allowed vlan 1,2,20
```



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Packet Tracer – Configuring EtherChannel

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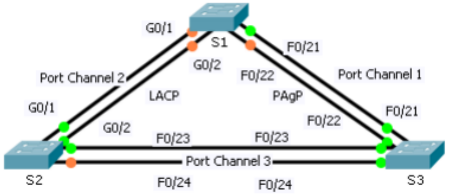
Packet Tracer – Configuring EtherChannel

Topology



Objectives

Part 1: Configure Basic Switch Settings

Part 2: Configure an EtherChannel with Cisco PAgP

Part 3: Configure an 802.3ad LACP EtherChannel

Part 4: Configure a Redundant EtherChannel Link

Background

Three switches have just been installed. There are redundant uplinks between the switches. Usually, only one of these links could be used; otherwise, a bridging loop might occur. However, using only one link utilizes only half of the available bandwidth. EtherChannel allows up to eight redundant links to be bundled together into one logical link. In this lab, you will configure Port Aggregation Protocol (PAgP), a Cisco EtherChannel protocol, and Link Aggregation Control Protocol (LACP), an IEEE 802.3ad open standard version of EtherChannel.

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Lab – Configuring EtherChannel

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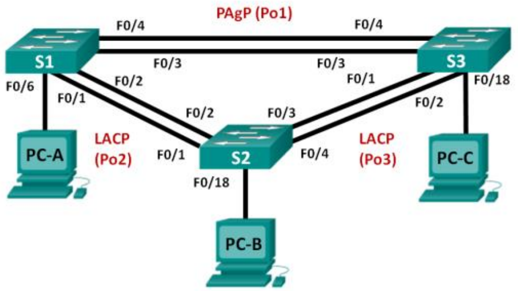
Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask
S1	VLAN 99	192.168.99.11	255.255.255.0
S2	VLAN 99	192.168.99.12	255.255.255.0
S3	VLAN 99	192.168.99.13	255.255.255.0
PC-A	NIC	192.168.10.1	255.255.255.0
PC-B	NIC	192.168.10.2	255.255.255.0
PC-C	NIC	192.168.10.3	255.255.255.0

Objectives

Part 1: Configure Basic Switch Settings

Part 2: Configure PAgP

Part 3: Configure LACP

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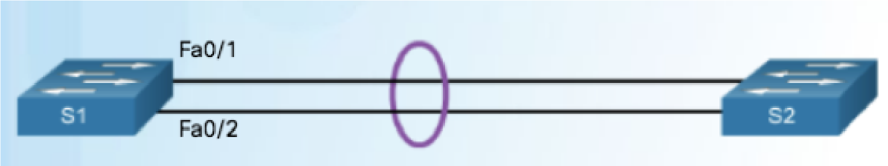
Verifying EtherChannel




```
S1# show interfaces port-channel 1
Port-channel1 is up, line protocol is up (connected)
  Hardware is EtherChannel, address is 0cd9.96e8.8a02 (bia
0cd9.96e8.8a02)
  MTU 1500 bytes, BW 200000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
<Output omitted>
```

Verifies the interface status.

```
S1# show etherchannel summary
Flags:  D - down        P - bundled in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator

        M - not in use, minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 1
Number of aggregators:           1

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-------------------------
1      Po1(SU)         LACP      Fa0/1(P)    Fa0/2(P)
```

Displays a one-line summary per channel group.
SU indicates in use.

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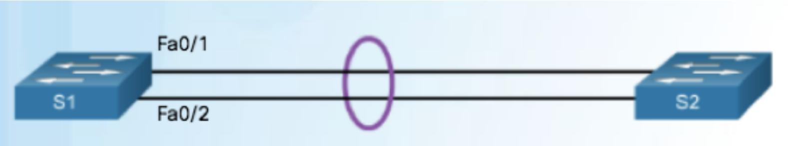
Verifying EtherChannel (Cont.)




```
S1# show etherchannel port-channel
Channel-group listing:
----------------------

Group: 1
----------
Port-channels in the group:
---------------------------

Port-channel: Po1    (Primary Aggregator)

------------

Age of the Port-channel   = 0d:06h:23m:49s
Logical slot/port   = 2/1          Number of ports = 2
HotStandBy port = null
Port state          = Port-channel Ag-Inuse
Protocol            =   LACP
Port security       = Disabled

Ports in the Port-channel:

Index   Load   Port     EC state        No of bits
------+------+------+------------------+-----------
  0     55     Fa0/1    Active             4
  1     45     Fa0/2    Active             4

Time since last port bundled:    0d:05h:52m:59s    Fa0/2
Time since last port Un-bundled: 0d:05h:53m:05s    Fa0/2
```

Displays port channel information.

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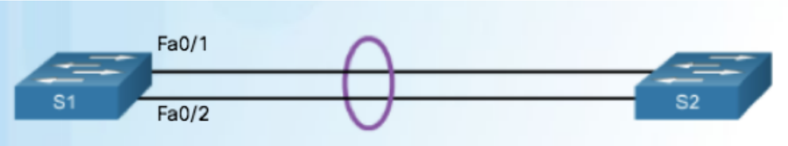
Verifying EtherChannel (Cont.)




```
S1# show interfaces f0/1 etherchannel
Port state    = Up Mstr Assoc In-Bndl
Channel group = 1           Mode = Active            Gcchange = -
Port-channel  = Po1         GC   =   -               Pseudo port-channel = Po1
Port index    = 0           Load = 0x00              Protocol =   LACP

Flags:  S - Device is sending Slow LACPDUs   F - Device is sending fast LACPDUs.
        A - Device is in active mode.        P - Device is in passive mode.

Local information:
                            LACP port     Admin     Oper    Port        Port
Port      Flags   State     Priority      Key       Key     Number      State
Fa0/1     SA      bndl      32768         0x1       0x1     0x102       0x3D

Partner's information:

                  LACP port                        Admin  Oper   Port    Port
Port      Flags   Priority  Dev ID           Age   key    Key    Number  State
Fa0/1     SA      32768     0cd9.96d2.4000   13s   0x0    0x1    0x102   0x3D

Age of the port in the current state: 0d:06h:06m:51s
```

Displays role of particular interface in an EtherChannel.

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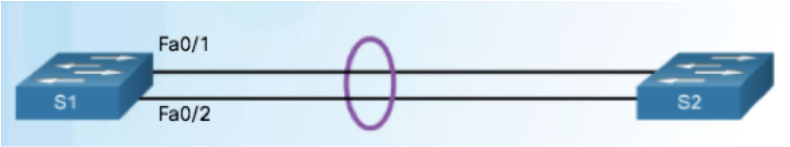
Troubleshooting EtherChannel



- All interfaces within EtherChannel must have the same:
  - speed
  - duplex mode
  - native and allowed VLANs on trunk (Ports with different native VLANs cannot form an EtherChannel.)
  - assigned to same VLAN

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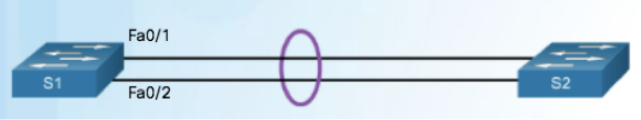
Troubleshooting EtherChannel (Cont.)




```
S1# show etherchannel summary
Flags:  D - down          P - bundled in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3      S - Layer2
        U - in use      f - failed to allocate aggregator

        M - not in use, minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 1
Number of aggregators:           1

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-------------------------
1      Po1(SD)         -         Fa0/1(D)    Fa0/2(D)
```

Output indicates that the EtherChannel is down (SD).

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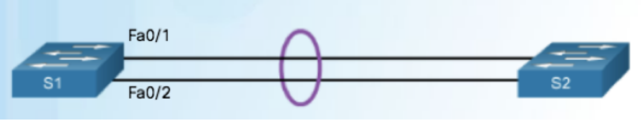
Troubleshooting EtherChannel (Cont.)




```
S1# show run | begin interface port-channel
interface Port-channel1
 switchport mode trunk
!
interface FastEthernet0/1
 switchport mode trunk
 channel-group 1 mode on
!
interface FastEthernet0/2
 switchport mode trunk
 channel-group 1 mode on
!
<Output omitted>
S2# show run | begin interface port-channel
interface Port-channel1
 switchport mode trunk
!
interface FastEthernet0/1
 switchport mode trunk
 channel-group 1 mode desirable
!
interface FastEthernet0/2
 switchport mode trunk
 channel-group 1 mode desirable
!

<Output omitted>
```

Incompatible PAgP modes configured on S1 and S2.

S1	S2	Channel Establishment
On	On	Yes
Auto/Desirable	Desirable	Yes
On/Auto/Desirable	Not Configured	No
On	Desirable	No
Auto/On	Auto	No

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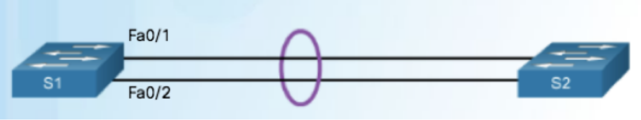
Troubleshooting EtherChannel (Cont.)




```
S1(config)# no interface port-channel 1
S1(config)# interface range f0/1 - 2
S1(config-if-range)# channel-group 1 mode desirable
Creating a port-channel interface Port-channel 1

S1(config-if-range)# no shutdown
S1(config-if-range)# interface port-channel 1
S1(config-if)# switchport mode trunk
S1(config-if)# end
S1# show etherchannel summary
Flags:  D - down         P - bundled in port-channel
        I - stand-alone s - suspended
        H - Hot-standby (LACP only)
        R - Layer3       S - Layer2
        U - in use       f - failed to allocate aggregator

        M - not in use, minimum links not met
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port


Number of channel-groups in use: 1
Number of aggregators:           1

Group  Port-channel  Protocol    Ports
------+-------------+-----------+-----------------------
1      Po1(SU)          PAgP      Fa0/1(P)     Fa0/2(P)
```

PAgP mode on the EtherChannel is changed to desirable and the EtherChannel becomes active.

S1	S2	Channel Establishment
On	On	Yes
Auto/Desirable	Desirable	Yes
On/Auto/Desirable	Not Configured	No
On	Desirable	No
Auto/On	Auto	No

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Packet Tracer – Troubleshooting EtherChannel

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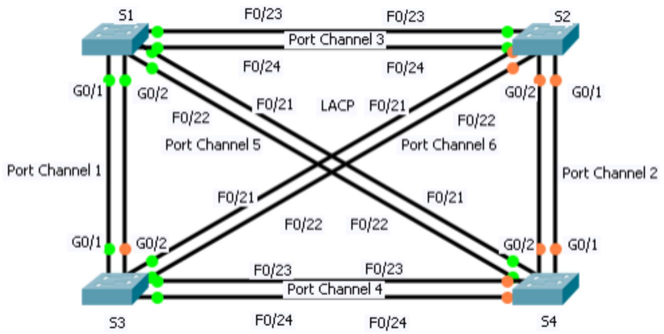
Packet Tracer – Troubleshooting EtherChannel

Topology



Objectives

Part 1: Examine the Physical Layer and Correct Switch Port Mode Issues

Part 2: Identify and Correct Port Channel Assignment Issues

Part 3: Identify and Correct Port Channel Protocol Issues

Background

Four switches were recently configured by a junior technician. Users are complaining that the network is running slow and would like you to investigate.

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Lab – Troubleshooting EtherChannel

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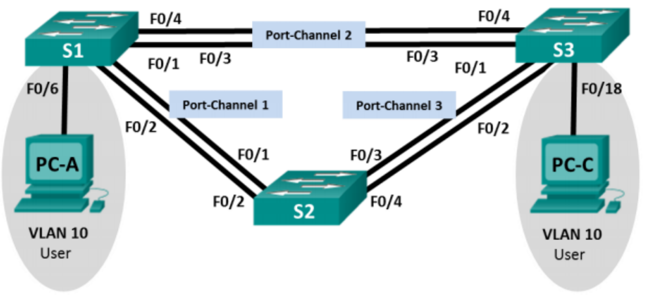
Lab – Troubleshooting EtherChannel

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask
S1	VLAN 99	192.168.1.11	255.255.255.0
S2	VLAN 99	192.168.1.12	255.255.255.0
S3	VLAN 99	192.168.1.13	255.255.255.0
PC-A	NIC	192.168.0.2	255.255.255.0
PC-C	NIC	192.168.0.3	255.255.255.0

VLAN Assignments

VLAN	Name
10	User
99	Management

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4.3 First Hop Redundancy Protocols

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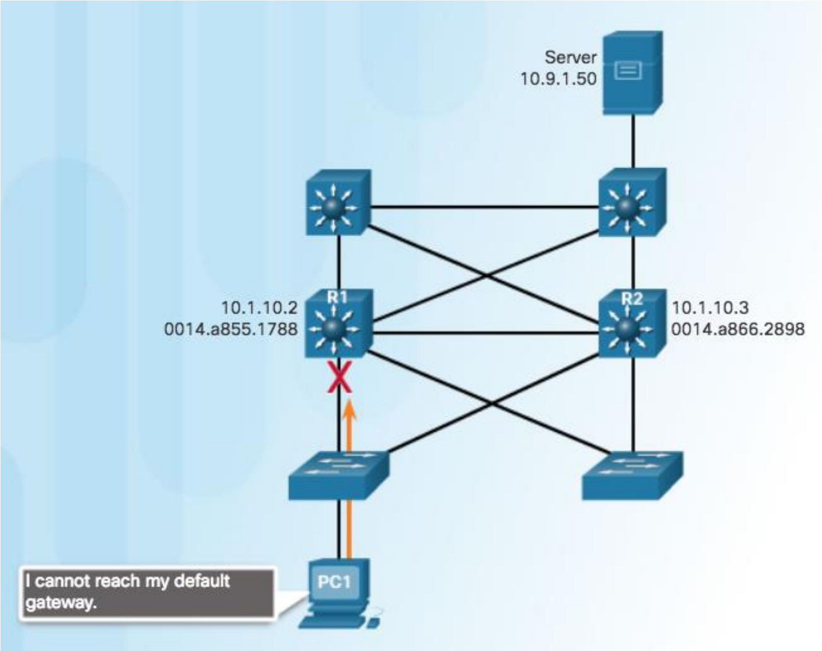
Default Gateway Limitations

- A mechanism is needed to provide alternate default gateways in switched networks where two or more routers are connected to the same VLANs.
  - Note: In the graphic, a multilayer switch is acting as the default gateway and used for routing.
  - In a switched network, each client receives only one default gateway.
  - There is no way to use a secondary gateway, even if a second path exists to carry packets off the local segment.
  - In the figure, R1 is responsible for routing packets from PC1. If R1 becomes unavailable, R2 can route packets that would have gone through R1.



- End devices are typically configured with a single IP address for a default gateway.
- If that default gateway IP address cannot be reached, the local device is unable to send packets off the local network.

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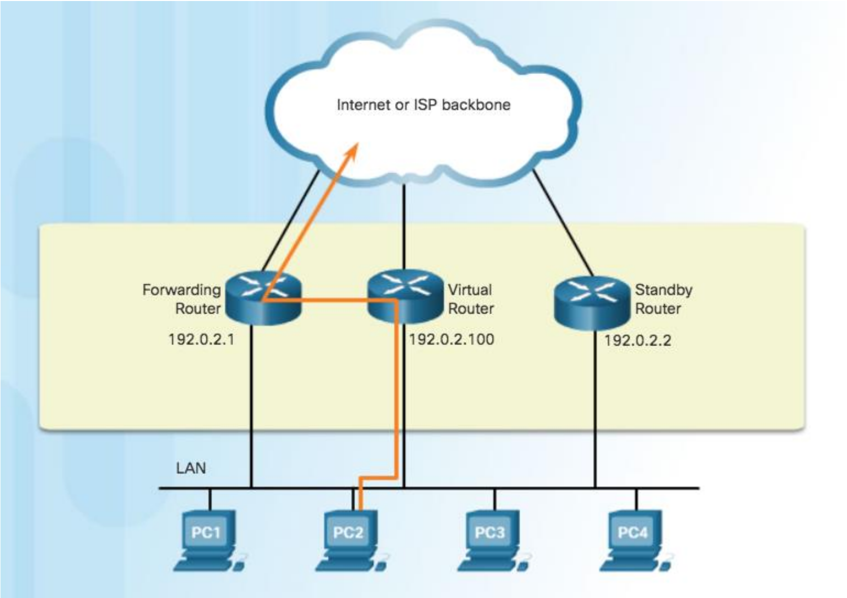
Router Redundancy

- To prevent a single point of failure at the default gateway, implement a virtual router.
  - Present the illusion of a single router to the hosts on the LAN.
  - By sharing an IP address and a MAC address, two or more routers can act as a single virtual router.
  - IPv4 address of the virtual router is configured as the default gateway for the workstations on a specific IPv4 segment.
  - ARP resolution returns the MAC address of the virtual router.
  - Physical router that forwards traffic is transparent to the host devices.



- A redundancy protocol provides the mechanism for determining which router should take the active role in forwarding traffic.
- Ability of a network to dynamically recover from the failure of a device acting as a default gateway is known as **first-hop redundancy**.

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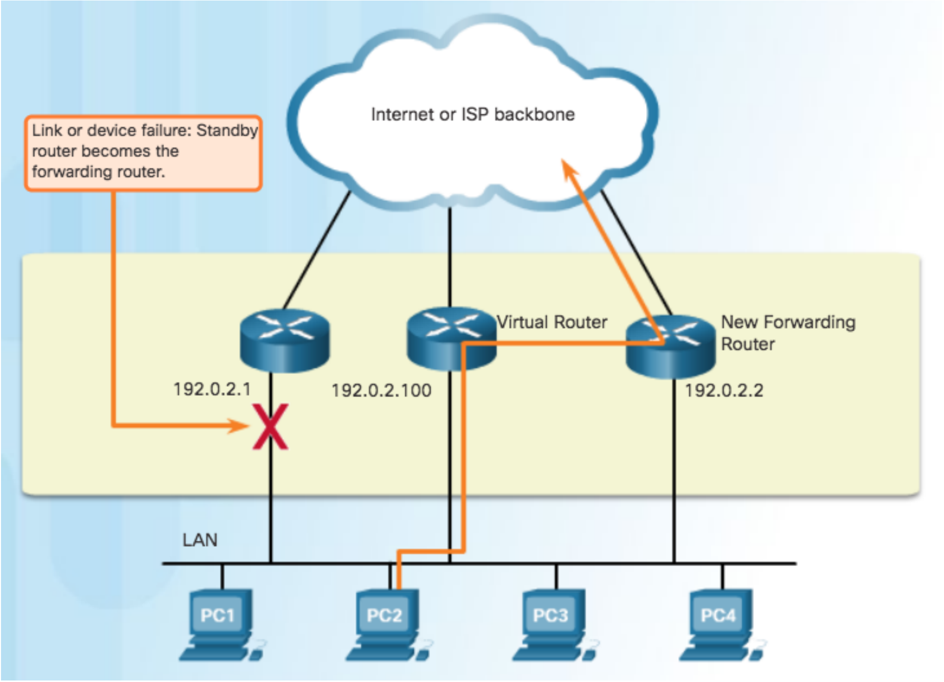
Steps for Router Failover

- When the active router fails, the redundancy protocol transitions the standby router to the new active router role.
- These are the steps that take place when the active router fails:

1. The standby router stops seeing hello messages from the forwarding router.
2. The standby router assumes the role of the forwarding router.
3. Because the new forwarding router assumes both the IPv4 and MAC addresses of the virtual router, the host devices see no disruption in service.



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First Hop Redundancy Protocols

- **Hot Standby Router Protocol (HSRP)** - A Cisco-proprietary FHRP designed to allow for transparent failover of a first-hop IPv4 device.
  - Active device is the device that is used for routing packets.
  - Standby device is the device that takes over when the active device fails.
  - Function of the HSRP standby router is to monitor the operational status of the HSRP group and to quickly assume packet-forwarding responsibility if the active router fails.
- **HSRP for IPv6** - Cisco-proprietary FHRP providing the same functionality of HSRP, but in an IPv6 environment.

- HSRP defines a group of routers - one active and one standby.
- Virtual IP and MAC addresses are shared between the two routers.
- To verify HSRP state, use the `show standby` command.
- HSRP is Cisco proprietary.
- VRRP is a standard protocol.

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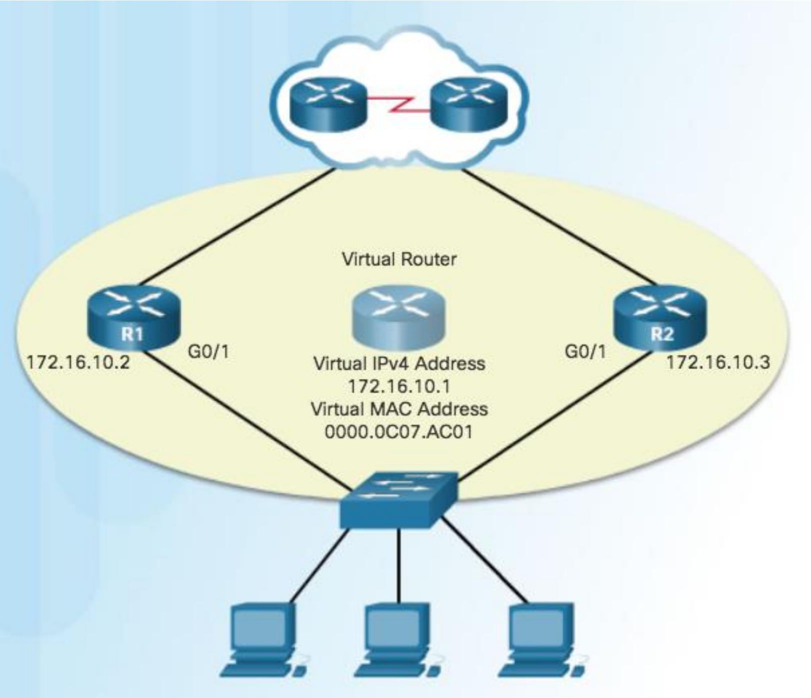
First Hop Redundancy Protocols (Cont.)

- **Virtual Router Redundancy Protocol version 2 -** A nonproprietary protocol that dynamically assigns responsibility for one or more virtual routers to the VRRP routers on an IPv4 LAN.
  - One router is elected as the virtual router master, with the other routers acting as backups, in case the virtual router master fails.
- **VRRPv3** - Capability to support IPv4 and IPv6.
- **Gateway Load Balancing Protocol (GLBP) -** Cisco-proprietary FHRP that protects data traffic from a failed router or circuit allowing **load balancing** between a group of redundant routers.
- **GLBP for IPv6 -** Cisco-proprietary FHRP providing the same functionality of GLBP.

- HSRP defines a group of routers - one active and one standby.
- Virtual IP and MAC addresses are shared between the two routers.
- To verify HSRP state, use the **`show standby`** command.
- HSRP is Cisco proprietary.
- VRRP is a standard protocol.

HSRP Overview



- One of the routers is selected by HSRP to be the active router and default gateway.
- Other router will become the standby router.
- If active router fails, standby assumes the role of active router and default gateway.
- Hosts are configured with single default gateway VIRTUAL address that is recognizable by both the active and standby routers.

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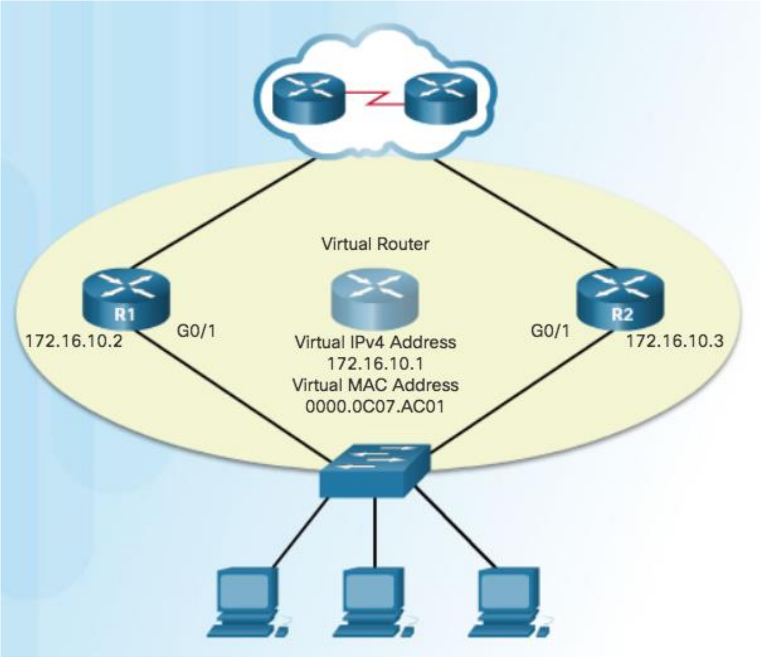
HSRP Versions



Version	HSRP V1 (Default)	HSRP V2
Group numbers	0 to 255	0 to 4095
Multicast address	224.0.0.2	224.0.0.102 or FF02::66
Virtual MAC address	0000.0C07.AC00 - 0000.0C07.ACFF (last two digits group number)	**IPv4** 0000.0C9F.F000 to 0000.0C9F.FFFF **IPv6** 0005.73A0.0000-0005.73A0.0FFF (last three digits group number)
Support for MD5 authentication	No	Yes

Note: For our labs, use group number 1.

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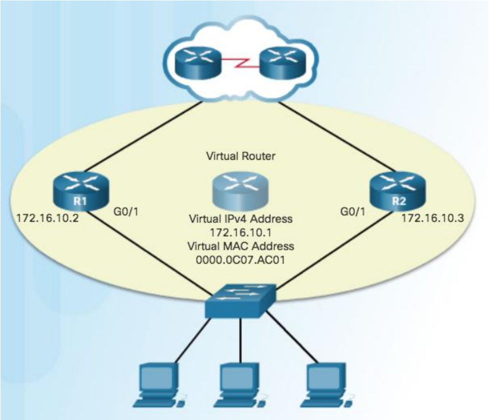
HSRP Priority and Preemption

- Role of active and standby routers determined by election process.
- By default, the router with the numerically highest IPv4 address is elected as the active router.
- Control HSRP election with priority and do not use highest address.
- HSRP Priority
  - Used to determine active router.
  - Default HSRP priority is 100.
  - Range is 0 to 255 and router with highest priority will become active.
  - Use the **standby priority interface** command.



- HSRP Preemption
  - Preemption - ability of HSRP router to trigger the re-election process.
  - To force a new HSRP election process, preemption must be enabled using **standby preempt interface.**
  - A router that comes online with the a higher priority will become the active router.

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HSRP Operations

HSRP States and Timers

State	Definition
Initial	This state is entered through a configuration change or when an interface first becomes available.
Learn	The router has not determined the virtual IP address and has not yet seen a hello message from the active router. In this state, the router waits to hear from the active router.
Listen	The router knows the virtual IP address, but the router is neither the active router nor the standby router. It listens for hello messages from those routers.
Speak	The router sends periodic hello messages and actively participates in the election of the active and/or standby router.
Standby	The router is a candidate to become the next active router and sends periodic hello messages.
Active	The router currently forwards packets that are sent to the group virtual MAC address. The router sends periodic hello messages.

- The active and standby HSRP routers send hello packets to the HSRP group multicast address every 3 seconds, by default. The standby router will become active if it does not receive a hello message from the active router after 10 seconds.
- You can lower these timer settings to speed up the failover or preemption. However, to avoid increased CPU usage and unnecessary standby state changes, do not set the hello timer below 1 second or the hold timer below 4 seconds.

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HSRP Configuration Commands

Step 1. Configure HSRP version 2.

Step 2. Configure the virtual IP address for the group.

Step 3. Configure the priority for the desired active router to be greater than 100.

Step 4. Configure the active router to preempt the standby router in cases where the active router comes online after the standby router.

Command	Definition
`Router(config-if)#` **`standby version 2`**	Configures HSRP to use version 2. HSRP version 1 is the default.
`Router(config-if)#` **`standby`** `[`*`group-number`*`]` *`ip-address`*	Configures the HSRP virtual IP address that will be used by the specified group. If no group is configured, then the virtual IP address is assigned to group 0.
`Router(config-if)#` **`standby`** `[`*`group-number`*`]` *`priority`* `[`*`priority-value`*`]`	Configures the desired active router with a higher priority than default priority of 100. Range is 0 to 255. If no priority is configured or if priority is equal, than the router with the highest IP address has priority.
`Router(config-if)#` **`standby`** `[`*`group-number`*`]` *`preempt`*	Configures a router to preempt the currently active router.

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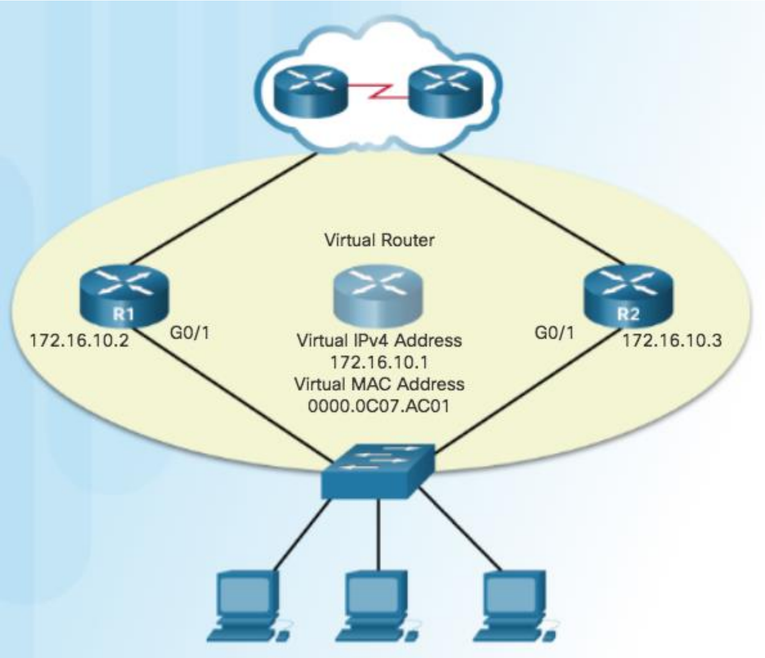
HSRP Sample Configuration




```
R1(config)# interface g0/1
R1(config-if)# ip address 172.16.10.2 255.255.255.0
R1(config-if)# standby version 2
R1(config-if)# standby 1 ip 172.16.10.1
R1(config-if)# standby 1 priority 150
R1(config-if)# standby 1 preempt
R1(config-if)# no shutdown
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
R2(config)# interface g0/1
R2(config-if)# ip address 172.16.10.3 255.255.255.0
R2(config-if)# standby version 2
R2(config-if)# standby 1 ip 172.16.10.1
R2(config-if)# no shutdown
```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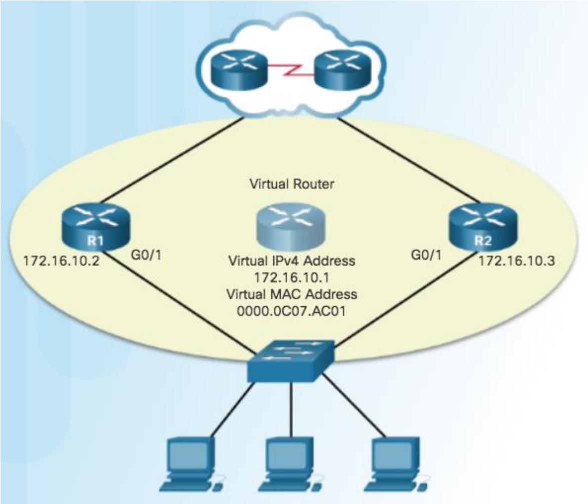
HSRP Verification




```
R1# show standby
GigabitEthernet0/1 - Group 1 (version 2)
  State is Active
    5 state changes, last state change 01:02:18
  Virtual IP address is 172.16.10.1
  Active virtual MAC address is 0000.0c9f.f001
    Local virtual MAC address is 0000.0c9f.f001 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.120 secs
  Preemption enabled
  Active router is local
  Standby router is 172.16.10.3, priority 100 (expires in 9.392 sec)
  Priority 150 (configured 150)
  Group name is "hsrp-Gi0/1-1" (default)
R1#
```

```
R2# show standby
GigabitEthernet0/1 - Group 1 (version 2)
  State is Standby
    5 state changes, last state change 01:03:59
  Virtual IP address is 172.16.10.1
  Active virtual MAC address is 0000.0c9f.f001
    Local virtual MAC address is 0000.0c9f.f001 (v2 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.944 secs
  Preemption disabled
  Active router is 172.16.10.2, priority 150 (expires in 8.160 sec)
    MAC address is fc99.4775.c3e1
  Standby router is local
  Priority 100 (default 100)
  Group name is "hsrp-Gi0/1-1" (default)
R2#
```

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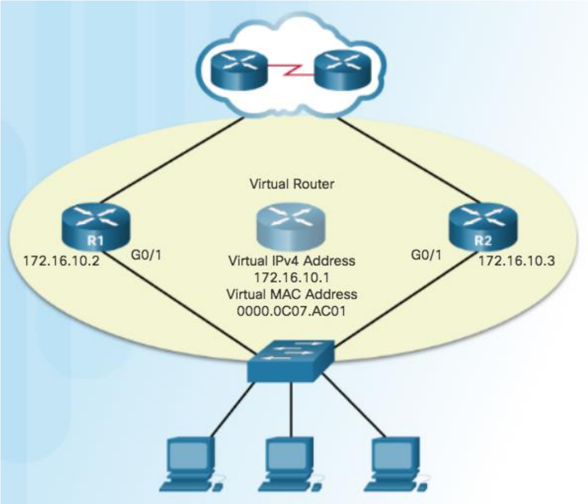
HSRP Configuration

HSRP Verification (Cont.)




```
R1# show standby brief
                     P indicates configured to preempt.
                     |
Interface   Grp  Pri P State   Active        Standby        Virtual IP
Gi0/1       1    150 P Active  local         172.16.10.3    172.16.10.1
R1#
```

```
R2# show standby brief
                     P indicates configured to preempt.
                     |
Interface   Grp  Pri P State   Active        Standby        Virtual IP
Gi0/1       1    100   Standby 172.16.10.2   local          172.16.10.1
R2#
```

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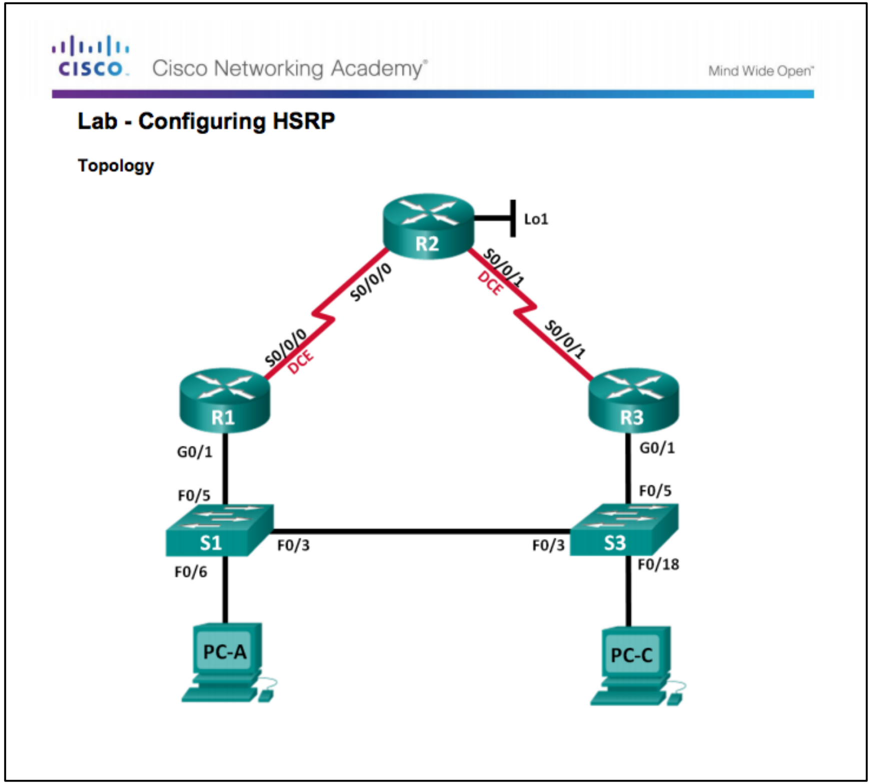
HSRP Configuration

Lab – Configure HSRP



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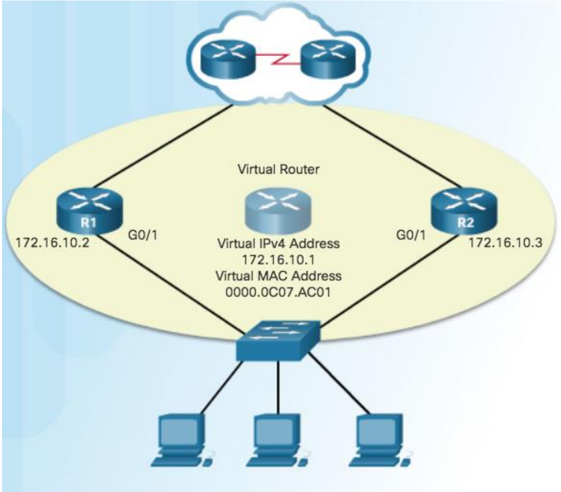
HSRP Failure

- Most issues will arise during one of the following HSRP functions:
  - Failing to successfully elect the active router that controls the virtual IP for the group
  - Failure of the standby router to successfully keep track of the active router
  - Failing to determine when control of the virtual IP for the group should be handed over to another router
  - Failure of end devices to successfully configure the virtual IP address as the default gateway



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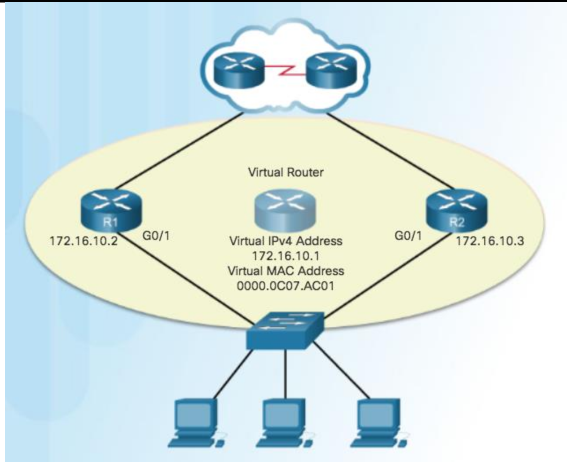
HSRP Debug Commands

```
R2# debug standby ?
  errors    HSRP errors
  events    HSRP events
  packets   HSRP packets terse
  Display limited range of HSRP errors, events and packets
  <cr>
```



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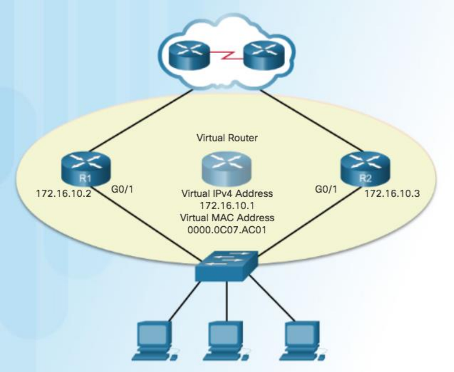
HSRP Debug Commands (Cont.)

View the HSRP Hello Packets on Standby Router

```
R2# debug standby packets
*Dec  2 15:20:12.347: HSRP: Gi0/1 Grp 1 Hello  in  172.16.10.2
  Active pri 150 vIP 172.16.10.1

*Dec  2 15:20:12.643: HSRP: Gi0/1 Grp 1 Hello  out 172.16.10.3
  Standby pri 100 vIP 172.16.10.1
```



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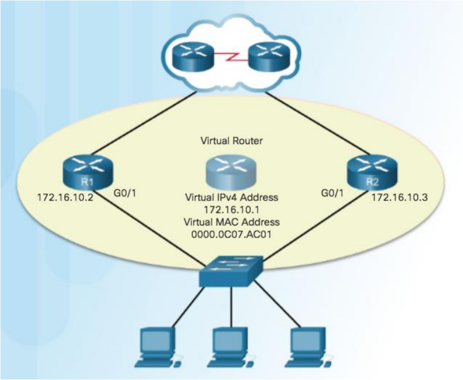
HSRP Troubleshooting

HSRP Debug Commands (Cont.)

R1 Fails and R2 is Elected Active HSRP Router

```
!!!!!!R1 is powered off!!!!!!
R2# debug standby terse
HSRP:
  HSRP Errors debugging is on
  HSRP Events debugging is on
    (protocol, neighbor, redundancy, track, arp, interface)
  HSRP Packets debugging is on
    (Coup, Resign)
R2#
*Dec  2 16:11:31.855: HSRP: Gi0/1 Grp 1 Standby: c/Active timer expired
  (172.16.10.2)
*Dec  2 16:11:31.855: HSRP: Gi0/1 Grp 1 Active router is local, was
  172.16.10.2
*Dec  2 16:11:31.855: HSRP: Gi0/1 Nbr 172.16.10.2 no longer active for
  group 1 (Standby)
*Dec  2 16:11:31.855: HSRP: Gi0/1 Nbr 172.16.10.2 Was active or standby
  - start passive holddown
*Dec  2 16:11:31.855: HSRP: Gi0/1 Grp 1 Standby router is unknown, was
  local
*Dec  2 16:11:31.855: HSRP: Gi0/1 Grp 1 Standby -> Active

R2#
```



Use **debug standby terse** to view the HSRP events as R1 is powered down and R2 assumes the role of active HSRP router for the 172.16.10.0/24 network.

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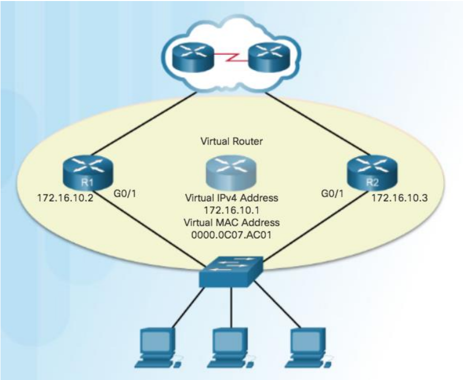
HSRP Debug Commands (Cont.)

R1 Initiates Coup to Become Active HSRP Router

```
R1#
*Dec  2 18:01:30.183: HSRP: Gi0/1 Nbr 172.16.10.2 Adv in, active 0
  passive 1
*Dec  2 18:01:30.183: HSRP: Gi0/1 Nbr 172.16.10.2 created
*Dec  2 18:01:30.183: HSRP: Gi0/1 Nbr 172.16.10.2 is passive
*Dec  2 18:01:32.443: HSRP: Gi0/1 Nbr 172.16.10.2 Adv in, active 1
  passive 1
*Dec  2 18:01:32.443: HSRP: Gi0/1 Nbr 172.16.10.2 is no longer passive
*Dec  2 18:01:32.443: HSRP: Gi0/1 Nbr 172.16.10.2 destroyed
*Dec  2 18:01:32.443: HSRP: Gi0/1 Grp 1 Coup   in  172.16.10.2 Listen
  pri 150 vIP 172.16.10.1
*Dec  2 18:01:32.443: HSRP: Gi0/1 Grp 1 Active: j/Coup rcvd from higher
  pri router (150/172.16.10.2)
*Dec  2 18:01:32.443: HSRP: Gi0/1 Grp 1 Active router is 172.16.10.2,
  was local
*Dec  2 18:01:32.443: HSRP: Gi0/1 Nbr 172.16.10.2 created
*Dec  2 18:01:32.443: HSRP: Gi0/1 Nbr 172.16.10.2 active for group 1
*Dec  2 18:01:32.443: HSRP: Gi0/1 Grp 1 Active -> Speak
*Dec  2 18:01:32.443: %HSRP-5-STATECHANGE: GigabitEthernet0/1 Grp 1
  state Active -> Speak
*Dec  2 18:01:32.443: HSRP: Gi0/1 Grp 1 Redundancy "hsrp-Gi0/1-1"
  state Active -> Speak
*Dec  2 18:01:32.443: HSRP: Gi0/1 Grp 1 Removed 172.16.10.1 from ARP
*Dec  2 18:01:32.443: HSRP: Gi0/1 IP Redundancy "hsrp-Gi0/1-1" update,
  Active -> Speak
*Dec  2 18:01:43.771: HSRP: Gi0/1 Grp 1 Speak: d/Standby timer expired
  (unknown)
*Dec  2 18:01:43.771: HSRP: Gi0/1 Grp 1 Standby router is local
*Dec  2 18:01:43.771: HSRP: Gi0/1 Grp 1 Speak -> Standby
```



Because R1 is configured with the **standby 1 preempt** command, it initiates a coup and assumes the role of active router. R2 actively listens to hello messages during the Speak state until it confirms that R1 is the new active router and R2 is the new standby router.

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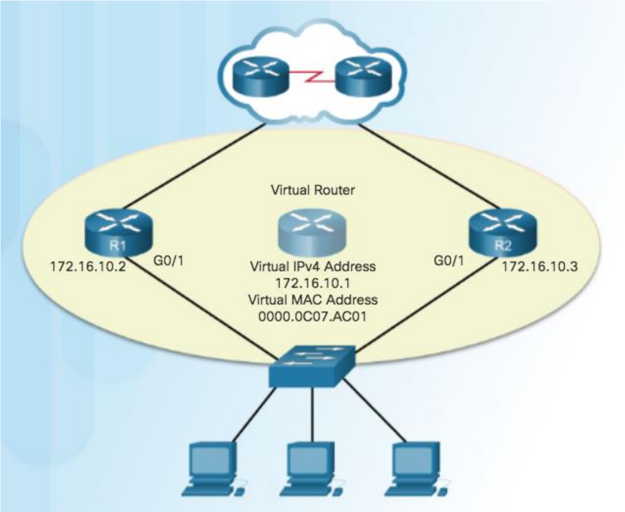
HSRP Debug Commands (Cont.)

R1 is Administratively Shutdown and Resigns as Active HSRP Router

```
R1(config)# interface g0/1
R1(config-if)# shutdown
R1(config-if)#
*Dec  2 17:36:20.275: %HSRP-5-STATECHANGE: GigabitEthernet0/1
   Grp 1 state Active -> Init
*Dec  2 17:36:22.275: %LINK-5-CHANGED: Interface
   GigabitEthernet0/1, changed state to administratively down
*Dec  2 17:36:23.275: %LINEPROTO-5-UPDOWN: Line protocol on
   Interface GigabitEthernet0/1, changed state to down
R1(config-if)#
!------------------------------------------------------------
R2#
*Dec  2 17:36:30.699: HSRP: Gi0/1 Grp 1 Resign in  172.16.10.2
   Active  pri 150 vIP 172.16.10.1
*Dec  2 17:36:30.699: HSRP: Gi0/1 Grp 1 Standby: i/Resign rcvd
   (150/172.16.10.2)
*Dec  2 17:36:30.699: HSRP: Gi0/1 Grp 1 Active router is local,
   was 172.16.10.2
*Dec  2 17:36:30.699: HSRP: Gi0/1 Nbr 172.16.10.2 no longer
   active for group 1 (Standby)
*Dec  2 17:36:30.699: HSRP: Gi0/1 Nbr 172.16.10.2 Was active
   or standby - start passive holddown
*Dec  2 17:36:30.699: HSRP: Gi0/1 Grp 1 Standby router is
   unknown, was local
*Dec  2 17:36:30.699: HSRP: Gi0/1 Grp 1 Standby -> Active
*Dec  2 17:36:30.699: %HSRP-5-STATECHANGE: GigabitEthernet0/1
   Grp 1 state Standby -> Active
*Dec  2 17:36:30.699: HSRP: Gi0/1 Grp 1 Redundancy "hsrp-
```



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Common HSRP Configuration Issues

Use the debug commands to detect common configuration issues:

- HSRP routers are not connected to the same network segment. Although this could be a physical layer issue, it could also be a VLAN subinterface configuration issue.
- HSRP routers are not configured with IPv4 addresses from the same subnet. HSRP hello packets are local. They are not routed beyond the network segment. Therefore, a standby router would not know when the active router fails.
- HSRP routers are not configured with the same virtual IPv4 address. The virtual IPv4 address is the default gateway for end devices.
- HSRP routers are not configured with the same HSRP group number. This will cause each router to assume the active role.
- End devices are not configured with the correct default gateway address. Although not directly related to HSRP, configuring the DHCP server with one of the real IP addresses of the HSRP router would mean that end devices would only have connectivity to remote networks when that HSRP router is active.

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Troubleshoot HSRP

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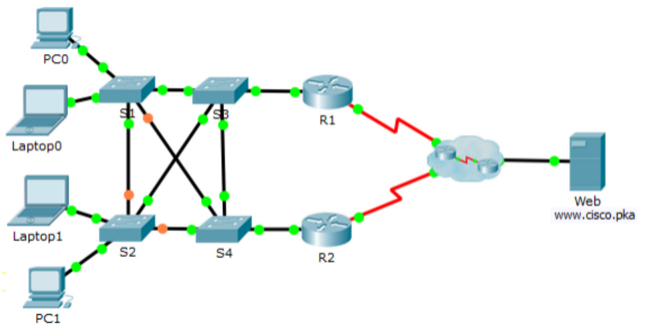
Packet Tracer - Troubleshoot HSRP

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0	209.165.200.226	255.255.255.252	N/A
R2	G0/1	192.168.1.2	255.255.255.0	N/A
	S0/0/1	209.165.200.230	255.255.255.252	N/A
PC0	NIC	192.168.1.10	255.255.255.0	192.168.1.254
Laptop0	NIC	192.168.1.11	255.255.255.0	192.168.1.254
Laptop1	NIC	192.168.1.12	255.255.255.0	192.168.1.254
PC1	NIC	192.168.1.13	255.255.255.0	192.168.1.254
Web	NIC	209.165.202.156	255.255.255.224	209.165.202.158

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4.4 Chapter Summary

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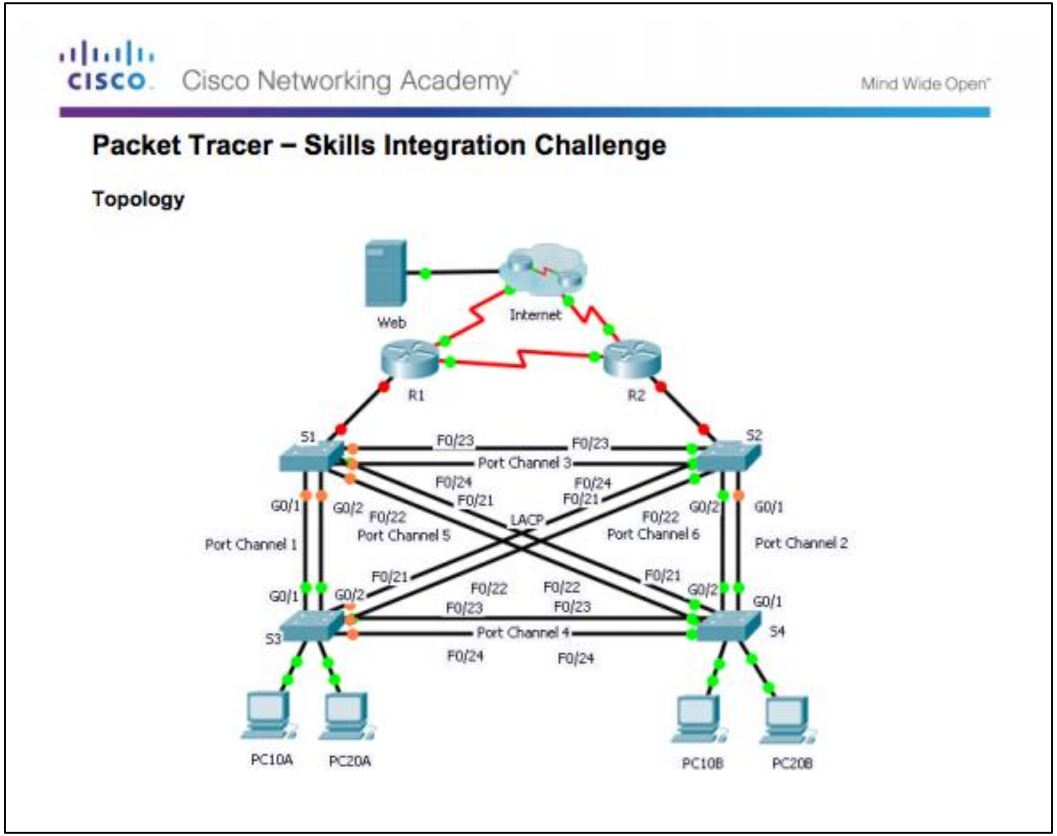
Summary

Packet Tracer – Skills Integration Challenge



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Conclusion

Chapter 4: EtherChannel and HSRP

- Explain link aggregation operation in a switched LAN environment.
- Implement link aggregation to improve performance on high-traffic switch links.
- Implement HSRP.

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